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International Conference on Electronic Business (ICEB)

Winter 12-9-2003

Investigating the Influence of Learner Diversity on the E-learning Acceptance

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Abstract

University students' demographics have been changing in the past two decades. Students diversity becomes an important factor in evaluating e-learning acceptance. Using a previously validated e-learning acceptance model, the paper investigated the construct means differences among various academic departments and between nontraditional continuing education and traditional higher education students, and tested the differences in model relationships between nontraditional and traditional student groups. Inferential statistics (t tests, ANOVA) and multiple-group Structural Equation Modeling (SEM) using LISREL were performed for the data analysis. The results revealed that different needs of various learner groups for e-learning, rather than academic discipline or gender, seem to drive the differences in intention to use IT for distance education and for supplementary learning. In addition, two relationships in the path model varied between nontraditional and traditional students groups. System functionality predicted intention to use e-learning as a supplementary learning tool for traditional students, but not for nontraditional students. Perceived usefulness predicted intention to use e-learning as a supplementary learning tool more strongly for nontraditional students than for traditional students. The implications for management and practices are discussed.

1. Introduction

E-learning has become an important teaching and learning tool worldwide [1] [17]. Most noticeably, it has been used or promoted in the following four areas: corporate training, universities, government, and K-12 education.

An e-learning system is an integrated system as opposed to stand-alone, single-function systems. Recently, more advanced e-learning systems, such as WebCT (http://www.webct.com) and Cyber University of NSYSU (http://cu.nsysu.edu.tw) have been developed. These systems are specifically designed for teaching and learning purposes and can be used to integrate course development tools, course material (audio, video, and text), e-mail, live chat sessions, online discussions, forums, and the World Wide Web. With this kind of system, instructional delivery and communication between instructors and students can be conducted either synchronously or asynchronously.

In the past two decades, demographics of university students have been changing in the U. S. and Taiwan [12] [6]. The two noticeable changes are: (1) the increase of female students and (2) the increase of older, working students. In the adoption of innovation (in this case, e-learning), the factors predicting e-learning adoption may vary across demographic groups. To better address e-learning adoption problem for different demographic groups, it is necessary to study the effects of these two changing factors on the e-learning adoption. For example, gender has been reported to have influence on the adoption of e-learning [5]. Appropriate actions can then be planned separately for either female or male group to improve the acceptance. The influence of another changing factor, students diversity, therefore is worth investigating. For example, older working students have a tendency to be enrolled as nontraditional continuing education students. Comparing with traditional higher education students, these nontraditional students generally have different living schedules and needs and, therefore, may vary in their intentions to use an e-learning system. The purpose of this study then is to investigate how learner (student) diversity will influence the acceptance of an e-learning system. In particular, the following research questions guided the study:

1. Do learners of different academic departments have similar perceptions and use intentions regarding e-learning acceptance?
2. Do non-traditional and traditional learners have similar perceptions and use intentions regarding e-learning?
3. Do the relationships between learners' behavioral intentions to use an e-learning system and determinant factors differ for non-traditional and traditional learners?

2. Literature Review

2.1 Research Model

Lee and Pituch [9] proposed and empirically supported an e-learning acceptance model as shown in Figure 1. The model is derived from the Technology Acceptance Model [10] and Diffusion of Innovation (DOI) perspective [14]. This model uses behavioral intention as a surrogate for IT acceptance of novice learners. The acceptance criteria were categorized into behavioral intentions to use the e-learning system as a supplementary learning tool (IU1) and as a distance education method (IU2). Lee and Pituch

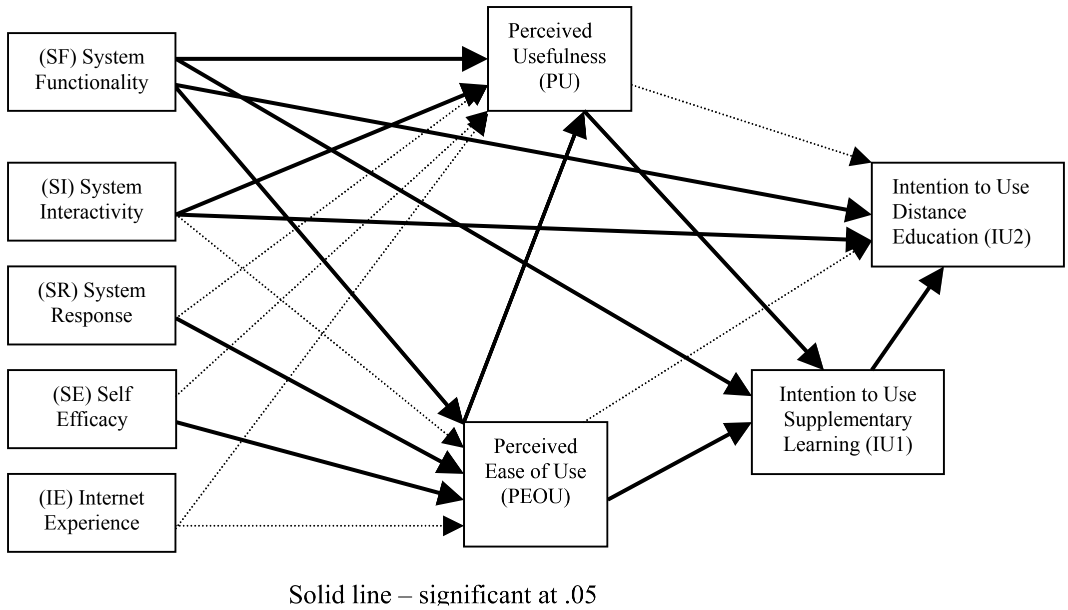

Figure 1. E-learning acceptance model (Lee & Pituch [9])

found that factors related to IT acceptance included perceived usefulness (PU), perceived ease of use (PEOU), system characteristics (functionality, interactivity, and response), and learner characteristics. The system characteristics are defined as follows. System functionality (SF) is a learner's opinion or perception of system functions related to learning and relative advantage as to time and place in learning. System interactivity (SI) is a learner's opinion or perception of the e-learning system's ability in enabling interactions between teacher and students, and among students themselves. System response (SR) is the degree to which a learner perceives whether the system response is fast/slow, consistent, and reasonable in requesting a system service [2]. For the learner characteristics, self-efficacy (SE), based on [4], is defined as one's self-confidence in his or her ability to perform certain learning tasks using an e-learning system. Internet experience (IE) is the extent to which a prospective learner uses the Internet [15].

2.2 The Influence of Learner Diversity

Human needs and behavior are related. Maslow's theory of the need hierarchy is the single most influential theory of human motivation. The theory indicates that there are five basic needs: physiological, safety, social, esteem, and self-actualization. These five needs are related to each other and are being arranged in a hierarchy of prepotency. The theory postulates that behavior is motivated biologically, culturally, and situationally to satisfy those needs.

Human needs influence their adoption behavior. Rogers [14] stated that compatibility of an innovation is an important determinant for adoption and compatibility is "the degree to which an innovation is compatible with the existing values, past experiences, and needs" (p. 224). Various demographic groups have different values, experiences, and needs, therefore, may affect IT adoption. For example, gender, as one of the demographics, was reported to have influence on IT adoption [6] [19] and, in particular, on e-learning adoption [10].

The diversity of learner investigated in this study includes two demographic factors: academic departments and educational divisions. For example, nontraditional students are those who most likely have full-time employment, attend school in the evening, and have a family. Technology advancement has enabled this group of learners to continue their education in ways that seemed impossible before [11] [18]. That is, they have needs to use e-learning technology to achieve their educational goals. An old proverb has stated, "Necessity is the mother of invention." Similarly, different needs between nontraditional and traditional students may influence their perceptions of the e-learning system and intentions to use such system.

The e-learning acceptance model (as shown in Figure 1) has been validated by prior research. It provides a sound framework for further research to identify if the construct means differed among students in various academic departments, and between nontraditional and traditional student groups. The relationships in the model is also examined to determine if they vary for nontraditional and traditional student groups.

3. Methodology

For this study, data collected from an earlier research [9] were grouped by academic departments and educational divisions. In brief, participants in the study consisted of postsecondary students enrolled in computer classes at a college in Taiwan. Students were given a 40-minute live demonstration of an e-learning system[1] and 30-minute to individually practice with it. A total of 259 surveys were collected from participants in the demonstration and practice. The response rate is 80.7% based on a total of 321 class members. Respondents were all in degreed programs, had ages ranging from 18 to 32 with an average of 22, and were relatively balanced between educational divisions (traditional higher education students 55.2%, non-traditional continuing education students 44.8%). The students were from several academic departments (MIS 76, Pharmacy 69, Healthcare Administration 81, others 33). The "others" category includes students from Nursing and Industrial Hygiene departments. The survey instrument was the same as the earlier study [9]. For Research Questions 1 and 2, inferential statistics such as one-way ANOVA and t tests were used to determine which factor means differed significantly among different academic departments or between educational divisions. For Research Questions 2, multi-group Structural Equation Modeling (SEM) approaches [3] [8] [16] using LISREL 8.50 were performed to determine the moderating effects of educational divisions on the research model. A measurement invariance across groups [7] is tested first. Then the differences in path coefficients between two groups are tested and identified [8].

4. Findings and Discussion

As shown in Table 1, with regard to students' intention to use e-learning for supplementary learning (IU1) and that for distance education (IU2), there are no significant differences among students in different academic departments (F = 0.91, 1.16; p = 0.436, 0.324 separately), using a 0.05 significant level. But there are significant differences in factor means of perceived ease of use (F = 3.08, p = 0.03), system functionality (F = 3.0, p = 0.03), and self-efficacy (F = 2.88; p = 0.04) among different departments. Furthermore, Tukey's post hoc analysis indicated that MIS students have a significantly higher perception of system functionalities than Pharmacy students, and "other" department's students have a significantly higher self-efficacy than Healthcare Administration students. Students in the "other" category were from Industrial Hygiene and Nursing departments and were taking the computer course as an elective. Generally, they should have interests and self confidence in IT. Therefore it is not unusual for this group of students to have a significantly higher self-efficacy than average students in Healthcare Administration. Using a significance level of 0.10, there are significant differences in Internet experience among different departments' students. As to the usefulness, system interactivity, and system response, there are no significant differences among different departments.

In the comparison between nontraditional and traditional students as shown in Table 2, nontraditional students have significantly higher perception of usefulness (t = 2.30, p = 0.02) and intention to use for distance education (t = 2.33, p = 0.02). Using a significance level of 0.10, nontraditional students have significantly higher perception of system functionality and intention to use for supplementary learning.

Table 1. Differences in factor means based on academic departments

	Academic Departments				ANOVA	
Factors	MIS	Pharmacy	Healthcare	Other	F	Prob.
PU	5.06	4.86	4.83	5.02	0.93	.43
PEOU	5.25	4.90	4.86	5.33	3.08	.03**
IU1	5.24	5.07	4.97	5.24	0.91	.44
IU2	5.39	5.04	5.13	5.27	1.16	.32
SF	5.91	5.43	5.69	5.82	3.00	.03**
SI	4.94	4.87	4.75	5.00	0.58	.63
SR	4.73	4.78	4.89	4.76	0.39	.76
SE	4.84	4.72	4.44	5.06	2.88	.04**
IE	5.32	5.10	4.83	5.32	2.35	.07*

Note. * p <.10. ** p < .05.

Table 2. Differences in factor means between nontraditional and traditional students groups

	Non-traditional		Traditional			
Factors	*M*	*SD*	*M*	*SD*	*t* value	Prob.
PU	5.08	0.93	4.80	1.00	2.30	.02**
PEOU	5.16	1.06	4.95	1.12	1.55	.12
IU1	5.26	1.10	5.00	1.14	1.87	.06*
IU2	5.39	1.10	5.04	1.28	2.33	.02**
SF	5.84	1.02	5.60	0.97	1.92	.06*
SI	4.97	1.09	4.79	1.13	1.26	.21
SR	4.91	1.00	4.71	0.99	1.58	.12
SE	4.66	1.21	4.75	1.10	0.59	.56
IE	5.05	1.40	5.15	1.18	0.61	.54

Note. * p <.10. ** p < .05.

An examination of the mean differences for the constructs between the nontraditional and traditional students through the path model (SE -> PEOU -> PU -> IU1 -> IU2) indicates that the difference is small for self-efficacy and generally increases on the path to IU2 as shown in Figure 2. The p value for the t-test of these difference decreases from .559 to .02. These results show that the educational division differences are in the latter part of the path model. Comparing with the gender study [10], the differences occurred at the opposing end of the path model.

The findings suggest that, although there is no difference in learners' confidence in using the e-learning technology, nontraditional students have higher beliefs of technology usefulness and higher intentions to use such technology for distance education than do the traditional learners. One possible explanation for these findings is that they may be driven by actual needs. Generally,

[1] The e-learning system used is the Cyber University at National Sun Yat-sen University (Taiwan). It provides Internet users with a guest account.

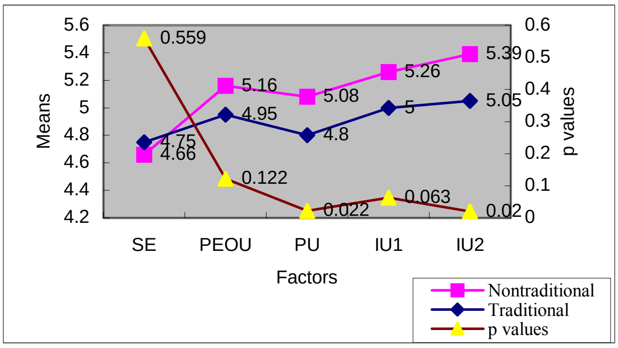

Figure 2. Trend of the differences in factor means between nontraditional and traditional groups

nontraditional students work full-time during the day, attend classes at night, and struggle with the responsibilities of work, family, and school. The e-learning technology provides a relative advantage in learning over a face-to-face class as to time and place independence and many-to-many communication. Using this technology as a distance education method would be more compatible with their living schedule and needs. Therefore, nontraditional learners perceive the technology more useful and have higher intention to use the technology as a distance education method. This is consistent with the compatibility characteristics of the innovation adoption theory [14]. Based on the same rationale, different academic departments' students may not have varying needs, therefore, their intentions to use the technology for either supplementary learning or distance education are indifferent. The same rationale can be applied to explain the indifference in the intentions to use between male and female students [10].

A multi-sample SEM was performed to compare the structural equation model over nontraditional and traditional students groups. The purpose of this analysis was to understand whether educational division had a moderating effect on the research model. Prior to testing the differences in model path estimates between non-traditional and traditional students, measurement models were tested for each group separately. Table 3 shows that the measurement models for both non-traditional and traditional students had adequate model fit. In addition, the difference in fit between a baseline model that allowed all factor loadings to vary across the two groups and a factor loading invariance model that constrained the factor loadings to be the same for these groups provides support for the more restrictive model. As presented in Table 3, the difference in the fit of these models is not statistically significant, $\chi2_{difference}$ (41, N = 259) = 49.69, p > .05. In addition, since the overall fit indicators provide support for the invariant factor loading model, this measurement model was used to test the difference in the relationships among constructs for the non-traditional and traditional learners.

Following the establishment of a common measurement model, multi-sample SEMs across educational divisions were performed. The first model tested path invariance by constraining all structural paths, reflecting the relationships among constructs, to be the same across both academic divisions. The model indicated an acceptable model fit, $\chi2$/df = 1.39, CFI = .962, NNFI = .956. However, the modification indices indicated that the chi-square would decrease 7.636 if the path from SF to IU1 were estimated separately for both groups. A second model was specified accordingly and tested. The fit of this model was acceptable, $\chi2$/df = 1.37, CFI = .963, NNFI = .957, and this model was more consistent with the data than the initial model, $\chi2_{difference}$ (1, N = 259) = 7.96, p < .05. For this second model, the modification indices indicated that the chi-square would decrease 6.895 if the path from PU to IU1 were estimated separately for each group. This third model was specified and tested. The model fit was acceptable, $\chi2$/df = 1.37, CFI = .964, NNFI = .958., and this third model had better overall fit than the second model, $\chi2_{difference}$ (1, N = 259) = 3.84, p = .05. Finally, the modification indices for this third model were all small and did not suggest any further refinements to the model.

The moderating effects of educational division on the relationships in the path model are presented in Table 4. The direct effects found to be the same across educational divisions are shown in the common metric column. The values shown in the nontraditional and traditional columns are the standardized path coefficients estimated separately for each group. In particular, system functionality predicted intention to use IT for supplementary learning for traditional students (0.504, significant) but not for nontraditional students (0.110, insignificant). Perceived usefulness predicted intention to use for supplementary learning more strongly for nontraditional students (0.511, significant) than for traditional students (0.287, significant). The multi-sample SEM path model for educational divisions is illustrated in Figure 3. One possible explanation is that the reason for having the intention to use the technology for supplementary learning might be different for nontraditional and traditional learners. Nontraditional learners generally have a higher tendency to miss some face-to-face classes due to family or work reasons. Thus, they may be more apt to rely on the technology to make up instruction time at home. The time and place flexibility in learning provided by system functionality, the many-to-many communication provided by system interactivity, all supported by a consistent and fast system response would enable them to do that. Therefore, belief of technology usefulness which is impacted by system functionality, system interactivity, and system response would have more influence in intention to use for supplementary learning for nontraditional than for traditional learners. But for traditional learners, most of them are full-time students, have a lower tendency to miss classes, and have more time to meet with instructors and other students. Therefore, system interactivity and system response are not as important. Instead, system functionality has more influence in their intention to use e-learning for supplementary learning.

5. Conclusions

Theoretically, this study further identifies some of the differences in the factor means of the e-learning acceptance model among students in different academic departments (MIS, Pharmacy, Healthcare Administration, and other), and between nontraditional and traditional student groups. An initial conclusion can be drawn from this research together with prior study [10] that different needs of various learner groups, rather than academic discipline or gender, seem to drive the differences in intention to use IT for distance education and for supplementary learning. Therefore, in practice, faculty members or educational administrators should promote or implement e-learning for student groups such as nontraditional students who have greater needs for the technology and are more likely to have higher intentions to use it.

In addition, two relationships in the path model varied for nontraditional and traditional student groups. Enhancing the usefulness of an e-learning system may substantially increase the likelihood that non-traditional students, especially, may use the system for supplementary learning purposes. That is, the overall system functionalities, interactivity, response, and ease of use need to be improved. In order to enhance traditional learners' intention to use the technology as a supplementary learning tool, improvements in system functionality would produce the most significant results. The implication is that faculty members or educational administrators can take different actions for various learner groups to improve their intention to use for supplementary learning purpose.

Acknowledgements

This research was supported by Tajen Institute of Technology, Taiwan (Grant No. Tajen92027).

Note: The full paper is available from the CD of conference proceedings.

Table 3. Test results of multi-group SEMs nontraditional and traditional students

Model	N	χ^2	df	χ^2/df $< 3.0^a$	χ^2_{diff}	df_{diff}	CFI $> .90^a$	NNFI $> .90^a$
Single Group CFA								
Traditional students	143	317.58*	216	1.47			0.963	0.953
Nontraditional students	116	292.63*	216	1.35			0.963	0.953
Multiple Group CFA								
Baseline (no constraints)	259	610.21*	432	1.41			0.963	0.953
Factor Loading Invariance	259	659.90*	473	1.40	49.69	41	0.961	0.955
Multiple Group SEM								
1. Paths Invariance	259	665.16*	480	1.39			0.962	0.956
2. Free SF->IU1	259	657.20*	479	1.37	7.96*	1	0.963	0.957
3. Free PU->IU1	259	653.36*	478	1.37	3.84*	1	0.964	0.958

[a] Recommended values. * $p < .05$.

Table 4. The moderating effects of nontraditional versus traditional students

		Standardized Direct Effects		
Outcome	Determinant	Common Metric	Nontraditional	Traditional
Perceived Ease of Use	System Functionality	0.133*		
	System Interactivity	0.112		
	System Response	0.276*		
	Self-efficacy	0.358*		
	Internet Experience	0.083		
Perceived Usefulness	Perceived Ease of Use	0.229*		
	System Functionality	0.089		
	System Interactivity	0.369*		
	System Response	0.127		
	Self-efficacy	-0.117		
	Internet Experience	0.138		
Intention to Use 1 (Supplementary tool)	Perceived Usefulness		0.511*	0.287*
	Perceived Ease of Use	0.254*		
	System Functionality		0.110	0.504*
Intention to Use 2 (Distance Education)	Intention to Use 1	0.426*		
	Perceived Usefulness	0.076		
	Perceived Ease of Use	0.075		
	System Functionality	0.226*		
	System Interactivity	0.151*		

Note. $N = 259$. $^{*}\ p < .05$.

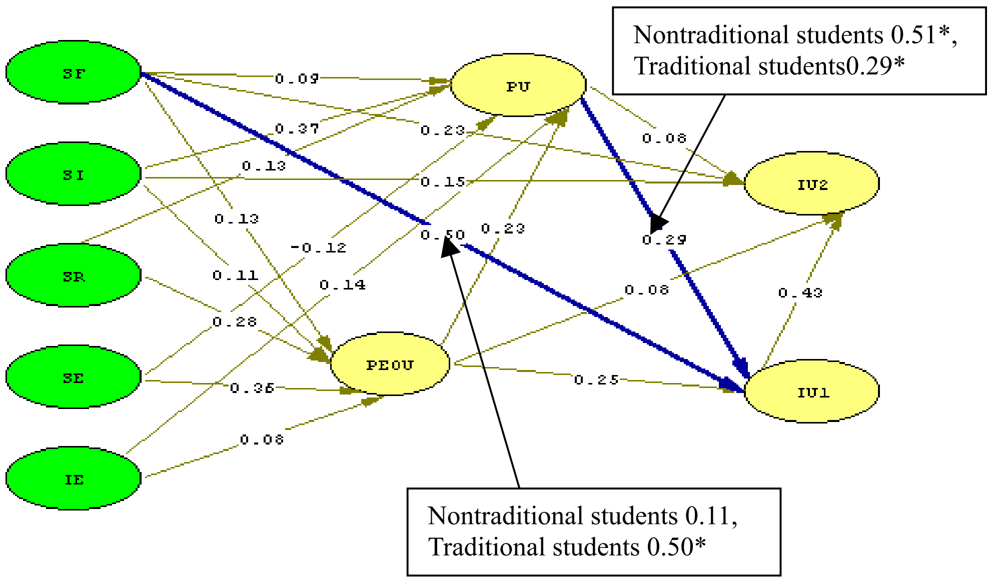

Figure 3. Multi-group SEM results for nontraditional versus traditional learners

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